

I. PROJECT PLANNING (27%) - This area assesses the candidate's ability to establish project objectives and develop a scope for the hydrogeologic work.

<i>Job Task</i>	<i>Knowledge</i>
<p>T6. Identify needs for water supply protection.</p> <p>T11. Identify needs for water supply restoration/remediation.</p> <p>T16. Identify need to perform a contamination assessment based on legal/regulatory requirements.</p> <p>T21. Identify need for control of groundwater flow direction or head.</p> <p>T25. Identify regional groundwater management issues.</p> <p>T29. Identify potential sources of water supply.</p> <p>T33. Identify water resource impacts on designated beneficial use.</p> <p>T37. Identify consequences of changes to water table or potentiometric surface.</p> <p>T41. Identify consequences of contamination on land ownership, liability, land values, and water rights.</p> <p>T45. Identify consequences of groundwater management decisions on future land and water uses.</p> <p>T49. Identify existing site conditions that may constrain investigation approach.</p> <p>T56. Prioritize schedule and location for soil and/or groundwater remediation.</p> <p>T60. Develop a conceptual hydrogeologic model.</p> <p>T64. Develop an investigation approach to achieve project objectives.</p> <p>T68. Identify type, collection methods, and quantity of data needed to achieve project objectives.</p>	<p>K1. Knowledge of the major components of groundwater supply systems.</p> <p>K6. Knowledge of the sources of hydrogeological data.</p> <p>K11. Knowledge of the hydrologic cycle.</p> <p>K16. Knowledge of the beneficial use as designated by state law.</p> <p>K26. Knowledge of the effect of federal, state, and local water quality standards on the evaluation of water quality data.</p> <p>K31. Knowledge of specific regulatory agencies that have jurisdictional authority over a water supply.</p> <p>K35. Knowledge of specific regulatory agencies that have jurisdictional authority over water quality protection.</p> <p>K39. Knowledge of specific regulatory agencies that have jurisdictional authority over water rights.</p> <p>K43. Knowledge of the methods to develop conceptual hydrogeologic models.</p> <p>K47. Knowledge of the effects of existing site conditions on field studies.</p> <p>K52. Knowledge of the advantages and disadvantages of different site investigation methods.</p> <p>K56. Knowledge of the advantages and disadvantages of different drilling methods.</p> <p>K60. Knowledge of the advantages and disadvantages of different sampling methods.</p> <p>K64. Knowledge of the advantages and disadvantages of different well purge methods.</p> <p>K68. Knowledge of the advantages and disadvantages of different chemical analysis investigation methods.</p> <p>K72. Knowledge of the advantages and disadvantages of different measurements of field water quality parameter methods.</p> <p>K76. Knowledge of the effects of groundwater on soil and rock stability.</p> <p>K80. Knowledge of the procedures to validate the usefulness of hydrogeologic, hydrologic, and water quality data.</p> <p>K84. Knowledge of the regulations pertaining to health and safety at a worksite.</p> <p>K88. Knowledge of the hazards of chemical contaminant exposure.</p> <p>K92. Knowledge of the advantages and disadvantages of laboratory methods to determine physical properties of soil, rock, water, gas, and waste samples.</p> <p>K96. Knowledge of the advantages and disadvantages of laboratory methods to determine chemical concentrations in soil, rock, water, gas, and waste samples.</p>

I. PROJECT PLANNING (27%) - This area assesses the candidate's ability to establish project objectives and develop a scope for the hydrogeologic work.

<i>Job Task</i>	<i>Knowledge</i>
(continued)	
T76. Develop a groundwater investigation workplan. T80. Develop a groundwater monitoring program. T84. Select development, purge, and sampling methods/equipment. T88. Evaluate water resource management alternatives.	K100. Knowledge of the components of a monitoring program. K104. Knowledge of statistical methods to evaluate sample populations. K108. Knowledge of permits required for hydrogeologic investigation, construction, and destruction. K112. Knowledge of the elements of groundwater monitoring programs. K116. Knowledge of the standards of practice for site investigation and remediation.

II. FIELD DATA ACQUISITION (25%) – This area assesses the candidate’s ability to perform surface and subsurface exploration and document groundwater conditions.

<i>Job Task</i>	<i>Knowledge</i>
<p>T7. Verify current conditions and site features in the field.</p> <p>T17. Identify water resource boundaries and zones from available data or field observations.</p> <p>T22. Delineate the nature and extent of groundwater contamination.</p> <p>T38. Collect samples of surface or soil gas to evaluate soil or groundwater conditions.</p> <p>T42. Collect samples of soil to evaluate soil or groundwater conditions.</p> <p>T43. Prepare boring logs and well construction details to illustrate subsurface conditions.</p> <p>T46. Collect samples of sediment or waste to evaluate soil or groundwater conditions.</p> <p>T50. Collect samples of ground or surface water to evaluate groundwater conditions.</p> <p>T53. Obtain physical or chemical parameters from the laboratory to determine interaction between vadose zone and groundwater.</p> <p>T57. Evaluate the physical condition and construction of existing wells.</p> <p>T63. Identify lithology, stratigraphy, structure, changes in moisture, water levels, and other properties of geologic materials based on field observations to interpret groundwater conditions.</p> <p>T65. Interpret borehole geophysical logs to determine aquifer stratigraphy and properties.</p> <p>T67. Measure groundwater levels or free product thickness from wells.</p> <p>T69. Measure field water quality parameters.</p>	<p>K2. Knowledge of geologic logging techniques.</p> <p>K7. Knowledge of interpretive techniques for aerial photographs.</p> <p>K17. Knowledge of the interaction between groundwater and surface water.</p> <p>K27. Knowledge of borehole geophysical investigation techniques.</p> <p>K32. Knowledge of site reconnaissance and field mapping techniques.</p> <p>K36. Knowledge of the procedures to decontaminate drilling equipment and sampling tools.</p> <p>K40. Knowledge of borehole drilling and well completion techniques to prevent cross-contamination of aquifers.</p> <p>K44. Knowledge of drilling techniques and construction practices for different types of water supply wells.</p> <p>K48. Knowledge of federal laws, regulations, and policies pertaining to groundwater protection.</p> <p>K51. Knowledge of state laws, regulations, and policies pertaining to groundwater protection.</p> <p>K53. Knowledge of the classification systems for soil and rock.</p> <p>K55. Knowledge of the methods to determine hydraulic properties of saturated earth materials.</p> <p>K57. Knowledge of the methods to determine hydraulic properties of unsaturated earth materials.</p> <p>K59. Knowledge of techniques to site wells.</p> <p>K61. Knowledge of the purposes of different types of wells.</p> <p>K63. Knowledge of techniques to measure water level in wells.</p> <p>K65. Knowledge of techniques to measure well discharge.</p> <p>K67. Knowledge of the practical significance and implications of equilibrium aquifer tests.</p> <p>K69. Knowledge of the practical significance and implications of non-equilibrium aquifer tests.</p> <p>K71. Knowledge of the use and limitations of various aquifer test methods.</p> <p>K73. Knowledge of field procedures for aquifer tests.</p> <p>K74. Knowledge of graphical and tabular techniques for analysis and presentation of hydrogeologic data.</p> <p>K75. Knowledge of the similarities and differences in fractured and porous groundwater flow systems.</p>

II. FIELD DATA ACQUISITION (25%) – This area assesses the candidate’s ability to perform surface and subsurface exploration and document groundwater conditions.

<i>Job Task</i>	<i>Knowledge</i>
<p>(continued)</p> <p>T73. Assess well performance.</p> <p>T81. Supervise well drilling, installation, development, or testing.</p>	<p>K79. Knowledge of the techniques to measure groundwater flow in wells.</p> <p>K81. Knowledge of the procedures for assessing background fluctuations in water levels in wells.</p> <p>K83. Knowledge of well bore storage and skin effects on aquifer test results.</p> <p>K85. Knowledge of the techniques to analyze aquifer test data.</p> <p>K87. Knowledge of the effects of climate data on hydrogeologic investigations.</p> <p>K91. Knowledge of the analytical and numerical methods to determine hydraulic parameters for aquifers.</p> <p>K93. Knowledge of the analytical and numerical methods to model contaminant fate and transport.</p> <p>K97. Knowledge of the techniques and procedures used for water budget evaluations.</p> <p>K99. Knowledge of the effects of boundary conditions on water levels during pumping.</p> <p>K101. Knowledge of the field techniques to construct wells.</p> <p>K103. Knowledge of the techniques to obtain gas samples.</p> <p>K105. Knowledge of the techniques to obtain soil samples.</p> <p>K107. Knowledge of the techniques to obtain water samples.</p> <p>K109. Knowledge of the techniques to measure water migration rates.</p> <p>K113. Knowledge of fate and transport processes for chemical constituents.</p> <p>K115. Knowledge of the techniques to select a filter pack and screen size based on sieve analysis.</p> <p>K117. Knowledge of the limitations of field screening techniques for soil and groundwater samples.</p> <p>K119. Knowledge of inorganic water chemistry.</p> <p>K121. Knowledge of trace element and isotope chemistry.</p> <p>K122. Knowledge of the physical and chemical properties of organic compounds in soil and groundwater.</p> <p>K123. Knowledge of the statistical methods to evaluate soil or groundwater data.</p> <p>K124. Knowledge of the relationship between fresh water and saline water in aquifers.</p> <p>K125. Knowledge of the potential impact of groundwater extraction on land subsidence.</p>

III. DATA EVALUATION (37%) – This area assesses the candidate’s ability to interpret data from historic, field, and laboratory sources and evaluate technical and economic feasibility of groundwater projects.

<i>Job Task</i>	<i>Knowledge</i>
<p>T2. Identify previous land uses and conditions from photographs, topographic maps, and other available historical sources.</p> <p>T3. Analyze infiltration/percolation data to calculate recharge rates and permeability.</p> <p>T4. Evaluate remedial technologies for soil or groundwater.</p> <p>T8. Interpret hydrogeologic boundaries, heterogeneity, and/or anisotropy from single or multi-well tests.</p> <p>T9. Estimate schedule for site remediation and closure.</p> <p>T12. Identify possible recharge/discharge areas from maps, photographs, and historic records.</p> <p>T14. Develop cleanup goals for soil or groundwater remediation.</p> <p>T19. Develop criteria for a groundwater control/remediation system.</p> <p>T23. Estimate costs of contamination.</p> <p>T26. Identify the applicable data for hydrogeologic analysis by reviewing existing documents, records, maps, and well logs.</p> <p>T27. Identify surface water/groundwater interactions.</p> <p>T30. Collect data to prepare hydrologic inventory/water balance.</p> <p>T31. Estimate potential impacts of water resource development or use.</p> <p>T39. Characterize nature and extent of contamination based on laboratory analysis of soil gas or soil moisture samples.</p> <p>T47. Prepare interpretive hydrogeologic illustrations.</p>	<p>K3. Knowledge of the effects of recharge and pumpage of water on aquifer matrix response.</p> <p>K4. Knowledge of the advantages and disadvantages of soil remediation systems.</p> <p>K7. Knowledge of interpretive techniques for aerial photographs.</p> <p>K8. Knowledge of the effects of natural and human activities on groundwater quality and quantity.</p> <p>K9. Knowledge of the advantages and disadvantages of groundwater remediation systems.</p> <p>K13. Knowledge of the federal and state restrictions and requirements pertaining to location and operation of waste disposal and treatment facilities.</p> <p>K14. Knowledge of comparative costs for hydrogeologic portions of remedial alternatives.</p> <p>K17. Knowledge of interaction between groundwater and surface water.</p> <p>K18. Knowledge of the hydrologic investigation requirements for siting potential waste disposal and treatment sites.</p> <p>K19. Knowledge of the techniques and procedures to evaluate water supply alternatives.</p> <p>K22. Knowledge of surface geophysical investigation techniques.</p> <p>K23. Knowledge of the effects of climate on natural groundwater recharge.</p> <p>K24. Knowledge of the guidelines to establish cleanup goals.</p> <p>K27. Knowledge of borehole geophysical investigation techniques.</p> <p>K28. Knowledge of the principles of groundwater flow pertaining to confined and unconfined aquifers.</p> <p>K29. Knowledge of the methods to design and perform pilot tests for water supply or remediation.</p> <p>K32. Knowledge of site reconnaissance and field mapping techniques.</p> <p>K33. Knowledge of the effects of groundwater pumping on confined and unconfined aquifers.</p> <p>K37. Knowledge of the natural and human-related causes of land subsidence.</p> <p>K41. Knowledge of the effects of human- and animal-related disturbances on subsurface drainage and groundwater flow conditions.</p> <p>K45. Knowledge of the types and sources of contaminants associated with specific categories of land use and industrial processes.</p> <p>K49. Knowledge of the physical and chemical properties of contaminants affecting fate and transport.</p> <p>K53. Knowledge of classification systems for soil and rock.</p> <p>K54. Knowledge of the chemical and biochemical transformations of contaminants.</p>

III. DATA EVALUATION (37%) – This area assesses the candidate’s ability to interpret data from historic, field, and laboratory sources and evaluate technical and economic feasibility of groundwater projects.

<i>Job Task</i>	<i>Knowledge</i>
(continued)	K55. Knowledge of methods to determine hydraulic properties of saturated earth materials.
T51. Construct flow nets.	K58. Knowledge of the conditions that influence gas or fluid flow through an unsaturated/vadose zone.
T54. Construct time-series graphs of water level data.	K61. Knowledge of the purposes of different types of wells.
T58. Interpret trends from water level and /or quality data.	K62. Knowledge of the factors that affect migration of contaminants through soil.
T62. Prepare graphical representations of water quality data.	K63. Knowledge of techniques to measure water level in wells.
T66. Calculate vertical hydraulic gradients.	K65. Knowledge of techniques to measure well discharge.
T71. Calculate hydraulic parameters from aquifer test data.	K66. Knowledge of the effects of hydrogeologic facies on groundwater flow
T75. Determine aquifer parameters based on slug test.	K67. Knowledge of the practical significance and implications of equilibrium aquifer tests.
T82. Calculate fate and transport of contaminants in groundwater or vadose zone.	K69. Knowledge of the practical significance and implications of non-equilibrium aquifer tests.
T85. Prepare groundwater level/potentiometric contour maps.	K70. Knowledge of artificial recharge methods.
T86. Estimate contaminant levels for risk assessment.	K71. Knowledge of uses and limitations of various aquifer test methods.
T87. Prepare isoconcentration contour map.	K73. Knowledge of field procedures for aquifer tests.
	K74. Knowledge of graphical and tabular techniques for analysis and presentation of hydrogeologic data.
	K75. Knowledge of similarities and differences in fractured and porous groundwater flow systems.
	K77. Knowledge of the characteristics of nonlaminar flow in saturated and unsaturated systems.
	K78. Knowledge of the methods to calculate hydraulic gradients.
	K81. Knowledge of procedures for assessing background fluctuations in water levels in wells.
	K82. Knowledge of the methods to calculate groundwater flow rate and volume.
	K83. Knowledge of well bore storage and skin effects on aquifer tests results.
	K85. Knowledge of techniques to analyze aquifer test data.
	K86. Knowledge of the methods to design well fields for groundwater production.
	K87. Knowledge of effects of climate data on hydrogeologic investigations.
	K89. Knowledge of the methods to construct flow nets.
	K90. Knowledge of the physical models that simulate groundwater and vapor phase flow.
	K91. Knowledge of analytical and numerical methods to determine hydraulic parameters for aquifers.

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<i>Job Task</i>	<i>Knowledge</i>
(continued)	<p>K94. Knowledge of the analytical models that simulate groundwater and vapor phase flow.</p> <p>K97. Knowledge of technique and procedures used for wate budget evaluations.</p> <p>K98. Knowledge of the numerical models that simulate groundwater and vapor phase flow.</p> <p>K99. Knowledge of effects of boundary conditions on water levels during pumping.</p> <p>K101. Knowledge of field techniques to construct wells.</p> <p>K102. Knowledge of the physical models that simulate solute transport.</p> <p>K106. Knowledge of the analytical models that simulate solute transport.</p> <p>K107. Knowledge of techniques to obtain water samples.</p> <p>K109. Knowledge of techniques to measure water migration rates.</p> <p>K110. Knowledge of the numerical models that simulate solute transport.</p> <p>K113. Knowledge of fate and transport processes for chemical constitutents.</p> <p>K114. Knowledge of the unsaturated flow models that simulate moisture movement in the vadose zone.</p>

IV. DESIGN, INSTALLATION, AND IMPLEMENTATION (11%) – This area assesses the candidate’s ability to design monitoring and production wells, and design programs for treatment and production systems.

<i>Job Task</i>	<i>Knowledge</i>
<p>T5. Design a monitoring well.</p> <p>T10. Design a groundwater production well.</p> <p>T20. Provide hydrogeologic information for design of a water supply system.</p> <p>T24. Design a monitoring plan for natural attenuation remedy.</p> <p>T28. Design a monitoring plan for treatment or production system.</p> <p>T32. Design a monitoring plan for waste management units.</p> <p>T36. Verify performance of a remedial system.</p> <p>T40. Supervise the destruction of wells.</p> <p>T48. Estimate the residual contamination prior to the proposed time of closure.</p> <p>T78. Design a well field including number, location, flow rate, and spacing of wells.</p>	<p>K3. Knowledge of effects of recharge and pumpage of water on aquifer matrix response.</p> <p>K5. Knowledge of the permit requirements for construction of water supply and treatment systems.</p> <p>K8. Knowledge of effects of natural and human activities on groundwater quality and quantity.</p> <p>K10. Knowledge of the permit requirements for operation of supply and treatment systems.</p> <p>K15. Knowledge of the standards of practice for environmental impact assessment.</p> <p>K20. Knowledge of well construction techniques that prevent cross-contamination.</p> <p>K23. Knowledge of effects of climate on natural groundwater recharge.</p> <p>K25. Knowledge of well construction materials that minimize impact to water quality.</p> <p>K26. Knowledge of effects of federal, state, and local water quality standards on the evaluation of water quality data.</p> <p>K28. Knowledge of principles of groundwater flow pertaining to confined and unconfined aquifers.</p> <p>K30. Knowledge of the state and federal requirements pertaining to well construction/destruction.</p> <p>K31. Knowledge of specific regulatory agencies that have jurisdictional authority over a water supply.</p> <p>K33. Knowledge of effects of groundwater pumping on confined and unconfined aquifers.</p> <p>K34. Knowledge of post-closure monitoring requirements.</p> <p>K37. Knowledge of natural and human-related causes of land subsidence.</p> <p>K38. Knowledge of well design criteria for monitoring wells.</p> <p>K42. Knowledge of well design criteria for production wells.</p> <p>K43. Knowledge of methods to develop conceptual hydrogeologic models.</p> <p>K44. Knowledge of drilling techniques and construction practices for different types of water supply wells.</p> <p>K45. Knowledge of types and sources of contaminants associated with specific categories of land use and industrial processes.</p> <p>K46. Knowledge of well design criteria for vapor extraction wells.</p> <p>K59. Knowledge of techniques to site wells.</p> <p>K66. Knowledge of effects of hydrogeologic facies on groundwater flow.</p>

IV. DESIGN, INSTALLATION, AND IMPLEMENTATION (11%) – This area assesses the candidate’s ability to design monitoring and production wells, and design programs for treatment and production systems.

<i>Job Task</i>	<i>Knowledge</i>
(continued)	K78. Knowledge of methods to calculate hydraulic gradients. K82. Knowledge of methods to calculate groundwater flow rate and volume. K86. Knowledge of methods to design well fields for groundwater production. K93. Knowledge of analytical and numerical methods to model contaminant fate and transport. K94. Knowledge of analytical models that simulate groundwater and vapor phase flow. K98. Knowledge of numerical models that simulate groundwater and vapor phase flow. K100. Knowledge of components of a monitoring program. K104. Knowledge of statistical methods to evaluate sample populations.